HP Insight Dynamics 6.0 with WebSphere 7.0 and VMware ESX 4.0 on HP ProLiant BL460c G6 servers

Technical white paper

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Executive summary

In today's business environment, enterprises are looking for virtualization to help them get the most out of their IT investment while staying ahead of the pace of business change. HP Insight Dynamics for ProLiant is an integrated solution that lets you analyze and optimize physical and virtual resources.

Integrated by design, the Insight Dynamics suite delivers capabilities greater than the sum of its parts. It is built on proven technologies from HP, such as HP Insight Control. HP Insight Dynamics can also take advantage of HP Virtual Connect to bring the flexibility of virtualization to physical environments. The software seamlessly plugs into HP Systems Insight Manager, one of the industry's most popular platform management tools. Another important characteristic is its integration with other software environments, which permits bidirectional communication between Insight Dynamics and other commonly used management software tools, such as VMware vCenter and Microsoft® System Center. Changes can be seamlessly triggered in the converged infrastructure and reflected in third-party software.

This white paper focuses on the advantages of utilizing HP Insight Dynamics with IBM WebSphere Application Server V7.0. This paper will provide a brief overview on the HP Insight Dynamics software with a focus on logical servers and HP Insight Capacity Advisor Consolidation Software and covers several use-case scenarios for using HP Insight Dynamics in an IBM WebSphere Application Server environment.

The objectives of the proof of concept described in this document were to validate dynamic provisioning and re-provisioning in an IBM WebSphere environment on HP BladeSystem c-Class components using HP Insight Dynamics.

Target audience: The document is intended for customers using IBM WebSphere Application Server (WAS) on VMware ESX server with HP Insight Dynamics for ProLiant servers. Knowledge of these technologies as well as Oracle® RAC (Real Application Clusters) is assumed.

This white paper describes testing performed in Mar 2010.

Introduction

HP Insight Dynamics is advanced infrastructure lifecycle management software which allows you to instantly adjust to dynamic business demands – provision and modify a complex infrastructure in minutes. HP Insight Dynamics includes:

- Integrated infrastructure design with automated activation of servers, storage and networking
- Built-in capacity planning and rebalancing tools
- Automated disaster recovery and failover capabilities.

HP Insight Dynamics is the infrastructure management at the core of the HP BladeSystem Matrix, a converged infrastructure solution spanning servers, storage and network resources that is an ideal platform for delivering shared services.

HP Insight Dynamics unified, integrated management environment, built on the HP Systems Insight Manager (SIM) framework, the HP BladeSystem architecture and HP Virtual Connect (VC) technology. HP Insight Dynamics can help you reduce costs by providing a flexible computing environment to help maximize the efficiency of server resource utilization and maintain server availability. Several key capabilities of HP Insight Dynamics such as logical servers and capacity planning with HP Smart Solver technology provide administrators a way to quickly provision, move, plan, and reallocate resources as necessary to meet the application demands and reduce the costs of running their IT infrastructure.

This document is not intended to be a comprehensive implementation guide but focuses on describing the new management capabilities of Insight Dynamics; a proven and recommended model for the efficient, dynamic provisioning and re-provisioning of resources in an IBM WebSphere, VMware ESX environment.

All elements of the reference architecture are standard supported products available from HP, VMware and IBM.

Assumptions

This model requires familiarity with the following:

- HP Insight Dynamics for ProLiant
- HP BladeSystem components
- Virtual Connect / Virtual Connect Enterprise Manager
- HP Systems Insight Manager (HP SIM)
- HP StorageWorks Enterprise Virtual Array (EVA) storage architecture
- IBM WebSphere Application Server V7.0
- IBM HTTP Server V7.0
- VMware ESX 4.0 Server
- VMware vCenter Server

HP Insight Dynamics

HP Insight Dynamics is advanced infrastructure management software that helps you to provision infrastructure in minutes, optimize infrastructure confidently, and protect continuity of services. It is a single toolkit to accelerate complex IT projects, simplify daily operations, and manage data center capacity and power proactively.

HP Insight Dynamics builds on HP Insight Control, delivering a powerful and single integrated by-design toolkit to accelerate complex IT projects and simplify daily operations. By continuously analyzing and optimizing an adaptive infrastructure, Insight Dynamics can reduce the cost of common data center tasks up to 40%.

The key HP Insight Dynamics capabilities discussed in this white paper are logical server management and capacity planning. Logical servers enable administrators to move IBM WebSphere Applications servers between ESX servers using HP Virtual Machine Management (VMM) technology. The capacity planning capability collects and analyzes utilization data for the logical server workloads. These features are discussed in more detail below. For further information on this software, please visit, www.hp.com/go/insightdynamics.

Following are some of the key product capabilities

Capacity planning

- Capacity planning component enables detailed server capacity and power planning
- Smart Solver technology collects and analyzes historical data across thousands of variables on virtual and physical resources
- 5-Star ratings makes it easy to identify best fit candidates for workloads
- Automatically generated plans for consolidation and load balancing
- Estimation of the power consumption of different configurations
- Support for HP ProLiant, BladeSystem and Integrity servers

Configuration management

- Virtualization management visualizes physical and virtual infrastructure for HP ProLiant, BladeSystem and Integrity servers
- Logical server management – which allows you to manage physical and virtual servers in the same way
- Logical servers are server profiles, which are easily created and freely moved across physical and virtual machines

Logical server

A logical server is a server profile that is easily created and freely moved across physical and virtual machines. By detaching the logical identity from the physical resource, you can create or move logical servers on any suitable virtual or physical machine – on demand. This construct gives administrators the flexibility to quickly move server workload profiles between physical and virtual server resources on demand as the business requirements change. With this level of control, the efficiency of server resource utilization can be maximized and a level of availability can be provided in the event of a server failure. Power and cooling costs can also be controlled by taking logical server resources offline when the application doesn't require the system resources, and then brought back online when the demands of the application change.

The logical server profile describes a system image, including the operating system (OS), application, and configuration requirements like processors and memory, and unique identifiers such as MAC addresses and World Wide Names. In short, the logical server profile has everything that the OS and application stack require to operate. A logical server can then be applied to the creation of a virtual machine using software-layer abstraction (hypervisor technology) or to a physical machine using physical-layer abstraction (HP Virtual Connect technology).

Capacity Advisor

Another key component of HP Insight Dynamics is the HP Insight Capacity Advisor Consolidation functionality for capacity planning. Capacity Advisor is a real-time capacity planning tool that provides administrators with both real-time and historical data. This data can be used to help detect systems that are either over or under-utilized and to provide a forecasting mechanism based an extrapolation of the data. With this information, administrators can then easily move logical servers to rebalance the resource utilization in the environment. HP Labs has developed Smart Solver technology to aid in this process.

The Smart Solver technology provides a five-star rating system to indicate which physical servers are better matches when moving a logical server. The technology will analyze the historical Capacity Advisor data, including both system resource and power consumption metrics, and provide recommendations on the best fit for the various server workloads. Utilization limit modeling allows administrators to define service level objectives on system resources including the CPU, memory, disk, or network bandwidth. These limits can be configured on a global basis or defined for specific workloads, and are also taken into account by Smart Solver when recommending targets for the logical server. Smart Solver is used whenever a logical server is moved or activated to provide a ratings recommendation. However, this technology is especially useful for what-if analysis and consolidation of multiple workloads onto fewer physical servers.

This white paper utilized Capacity Advisor to analyze the performance data to help understand if a particular WebSphere virtual machine server resource was over-utilized and a potential performance concern. The paper did not look at using the what-if and forecasting capability of the Smart Solver technology to predict how workloads and logical servers could be more efficiently assigned.

HP Virtual Connect

HP Virtual Connect (VC) is an implementation of server-edge I/O virtualization that provides an abstraction layer between the LAN and SAN connections and the server. There are two VC interconnect options, the VC Ethernet and VC Fibre Channel (FC) modules. A single VC module plugs into one of the standard interconnect bays in the rear of the HP BladeSystem c-Class enclosures. For redundancy, an additional VC module can be installed in an adjacent interconnect bay.

The VC modules are not switch devices; rather the VC modules aggregate the LAN and SAN connections running from each of the server blades in the enclosure. External communications are then routed over uplinks on the VC Ethernet and FC modules to the first layer of switches in the environment. This eliminates the extra layer of switch management required when integrating the switches within the blade enclosure, but also simplifies and reduces the cabling for the enclosure.

HP Virtual Connect Enterprise Manager

HP Virtual Connect Enterprise Manager (VCEM) builds on the HP Virtual Connect technology and provides a single console to manage network infrastructure connections, a central resource pool for LAN and SAN address administration, and grouping capabilities that enable rapid server deployment and movement. VCEM is targeted for environments with multiple (usually four or more, up to 1,000 BladeSystem enclosures and 16,000 blade servers) HP BladeSystem enclosures to provide a centralized point of control for critical data center tasks such as new server blade provisioning, server recovery, planned maintenance, or rapid migration of servers, without massive disruption to the production LAN and SAN environment.

Solution criteria

HP Insight Dynamics provides system management capabilities that allow you to monitor WebSphere Application Server environment and as needed, make dynamic changes. Based on your business needs, you can set thresholds for these resources and dynamically make changes to provide the desired level of service. The logical servers imported can be activated, deactivated and moved depending on the business requirements.

Hardware

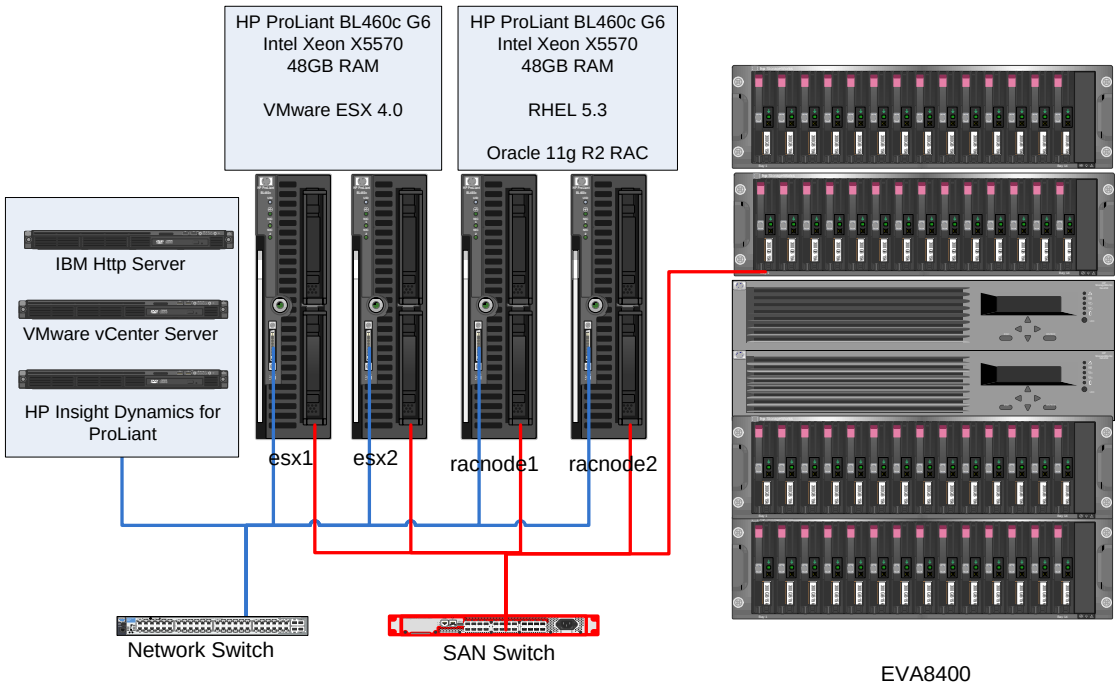
The following hardware was utilized to create the reference configuration shown in Figure 1:

- 2 HP ProLiant BL460c G6 server blades as WebSphere Application Servers
- 2 HP ProLiant BL460c G6 server blades as Oracle 11g RAC (Real Application Clusters) database servers
- HP StorageWorks 8400 Enterprise Virtual Array (EVA8400) for storage for the virtual machines and database.

WebSphere reference configuration

For the reference configuration two BL460c G6 blade servers are used in IBM WebSphere Application Server cluster and two BL460c G6 blade servers are configured in Oracle 11gR2 RAC configuration. Three additional DL360 servers are used: one for IBM HTTP server, one for HP SIM and Insight Dynamics and yet another as VMware vCenter server.

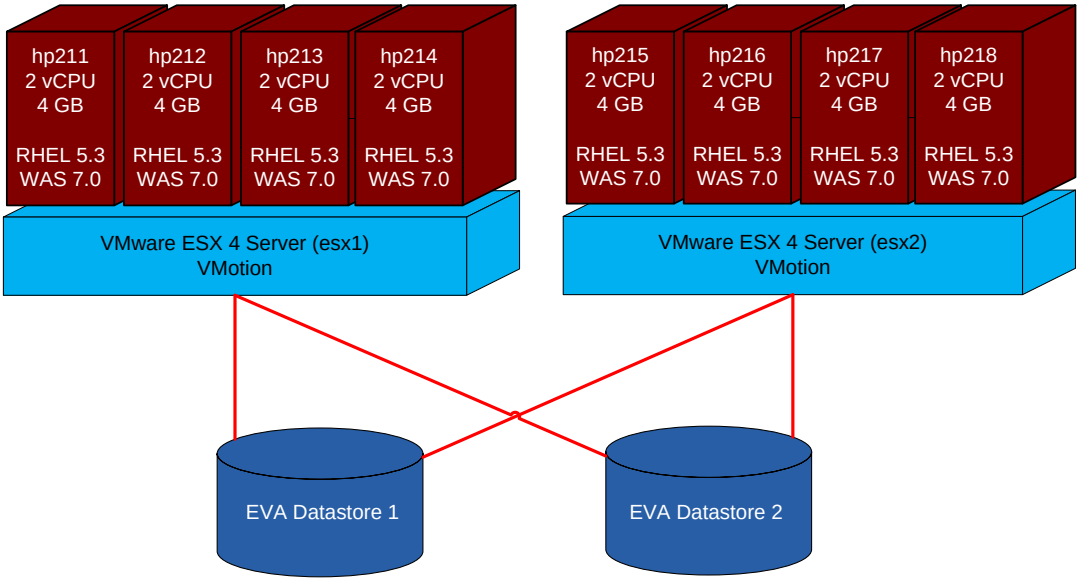
Figure 1. Reference configuration showing HP BladeSystem server roles



All BL460c servers are connected to EVA8400 SAN storage and LUNs are presented to the servers. Two 400GB Vdisks are presented to esx1 and esx2 servers. One 500GB Vdisk is presented to racnode1 and racnode2.

On each ESX server four virtual machines or logical servers are created. Each logical server is configured with 2 CPU cores, 4GB RAM, 20GB disk space and two network interfaces (one for web and one for database traffic) are configured. On each logical server Red Hat Enterprise Linux (RHEL) 5.3 operating system and IBM WebSphere Application Server 7.0 is installed. Each WebSphere instance is configured as part of a cluster as shown in Figure 2.

Figure 2. Virtual machine logical server configuration



HP SIM and Insight Dynamics setup

The first step in building out the environment was to rack the infrastructure as shown in Figure 1. Once the infrastructure was built, the next step was to install the necessary software on the management server. The HP Insight Dynamics software suite was installed and configured.

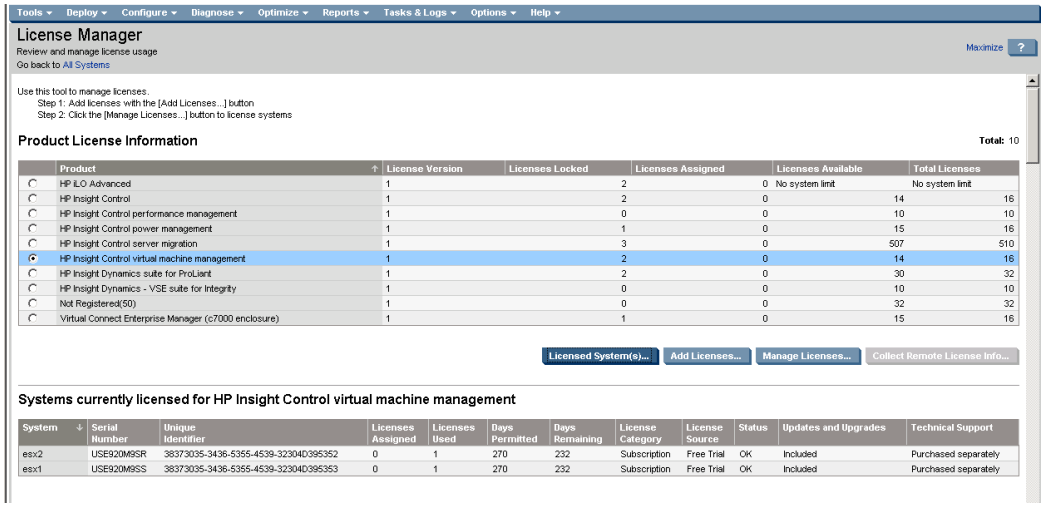
After the HP SIM Central Management Server (CMS) server was configured and licensed appropriately, the VC domain and VC domain group for this environment were created. A VC domain group is a collection of VC domains that define which enclosure resources (server blades, SAN fabrics, and Ethernet networks) are available to the logical server. The specific steps to creating a VC domain and VC domain group are outside the scope of this document.

With the CMS fully configured, the next step is to create and assign logical servers to WebSphere Application Server environment. One of the advantages of using HP Insight Dynamics logical servers with the HP BladeSystem and HP Virtual Connect architecture is that the majority of the network and SAN configuration can be done up front, prior to the OS being deployed. Then as servers are added to the environment, there is only minimal configuration that needs to be performed by the administrator.

Insight Dynamics license management

Add Insight Control and Insight Dynamics for ProLiant license keys in HP SIM. Apply appropriate license keys in HP SIM with License Manager and assign the licenses to the servers. Figure 3 shows HP Insight Control virtual machine management licenses are applied on esx1 and esx2 servers.

Figure 3. License manager



Configuring VMware vCenter

To configure VMware vCenter, select **Options > Virtual Machine Management > Security > VMware VirtualCenter Settings.**

This configuration is required for Live Move, which uses VMotion Technology. Also known as **Online Move**. It moves a running virtual machine, its operating system, and its applications from one VM Host to another VM Host without an operating system reboot or application restart. All I/O connections to storage and networks remain active throughout the move. It initiates VMware VMotion technology from HP SIM, and requires that vCenter is installed and running.

To perform operations such as copy, move, Live Move, and prefailure events on the HP integrated VMware ESX Server host, you must configure VirtualCenter.

Registering virtual machine hosts

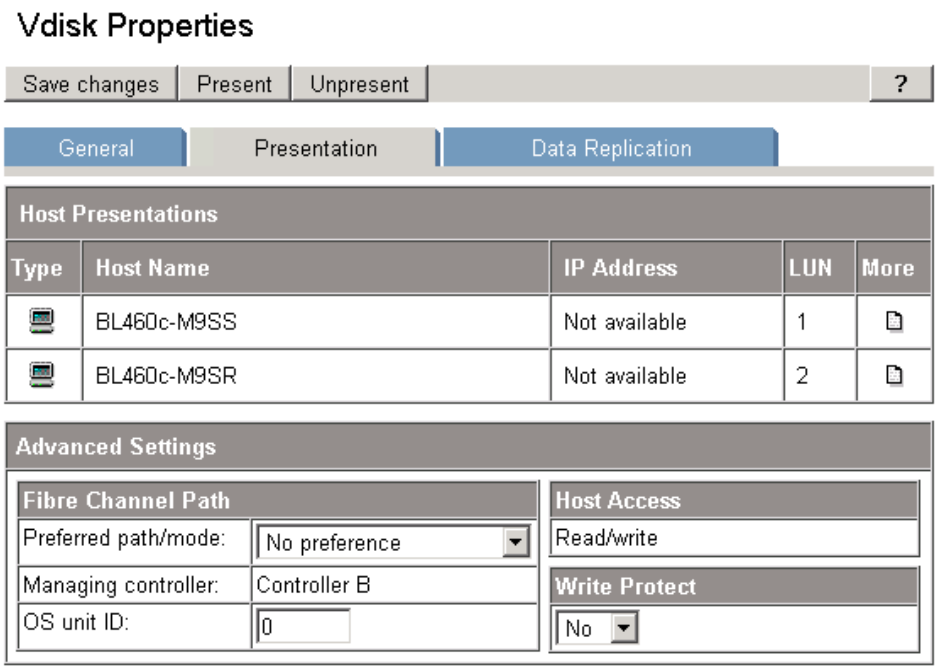
Before registering any version of a VMware ESX server, be sure they are licensed with a valid ESX license. VMware ESX servers with a base license or without any license are not managed by HP Virtual Machine Management Pack (VMM). Install appropriate licenses with HP SIM so that VMM agents are deployed on the VMware ESX servers. All the communications in Virtual Machine Management Pack use SSL digital certificates that are dynamically generated at the time of registering virtual machine host using the register agent feature of Virtual Machine Management Pack. To successfully communicate between the CMS and a virtual machine host or from one virtual machine host to another, the system date and time on the CMS and virtual machine hosts must be in sync.

Logical server Setup

EVA Vdisk presentation

Figure 4 shows virtual disks presentation to two BL460c servers that are used in the WAS cluster configuration. Also additional virtual disks are presented to the other two BL460c servers as part of the Oracle RAC cluster.

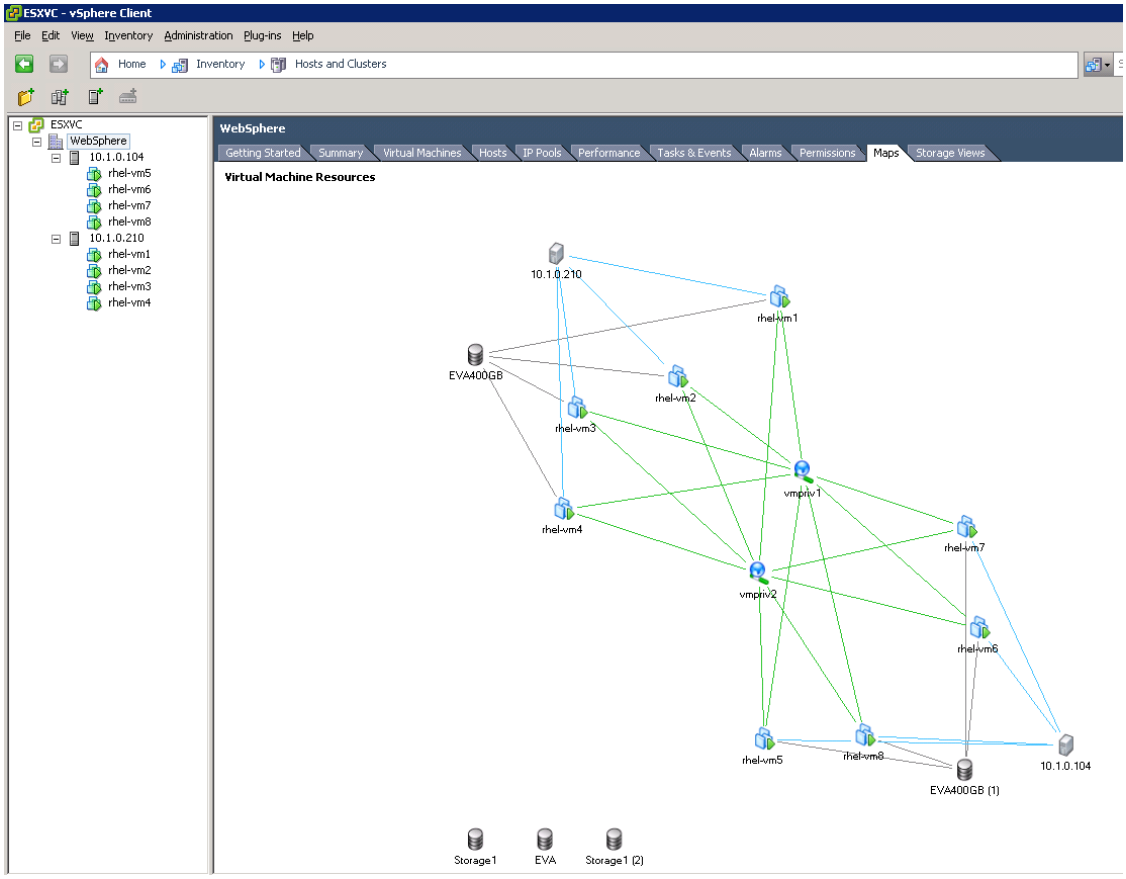
Figure 4. EVA virtual disk presentation



VMware vCenter configuration

Using VMware vSphere client, a data center cluster was created and esx1 and esx2 servers are added as part of the cluster. Figure 5 shows VMware vSphere client connected to vCenter server. The map shows the physical servers, virtual machines and storage resources connected in the current configuration.

Figure 5. VMware vCenter map



WebSphere Application Server cluster configuration

Figure 6 shows the WebSphere Application Server Network Deployment configuration used. The DayTrader application was installed on the TradeCluster with eight application servers, one WebSphere Application Server instance on each virtual machine.

Figure 6. Logical reference configuration

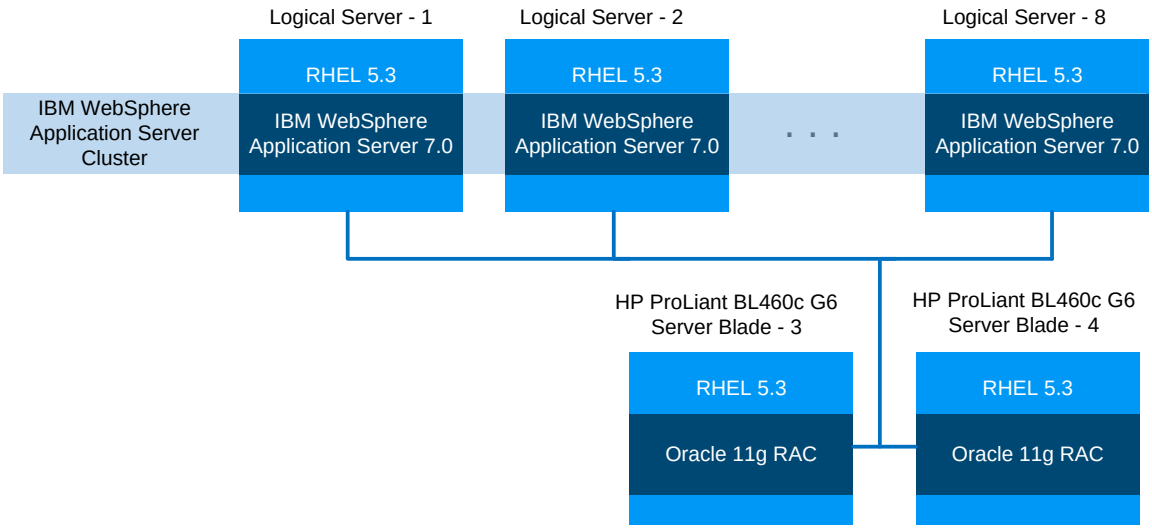

Logical Server - 1
Logical Server - 2
Logical Server - 8
RHEL 5.3
RHEL 5.3
RHEL 5.3
IBM WebSphere Application Server Cluster
IBM WebSphere Application Server 7.0
IBM WebSphere Application Server 7.0
IBM WebSphere Application Server 7.0
HP ProLiant BL460c G6 Server Blade - 3
HP ProLiant BL460c G6 Server Blade - 4
RHEL 5.3
RHEL 5.3
Oracle 11g RAC
Oracle 11g RAC

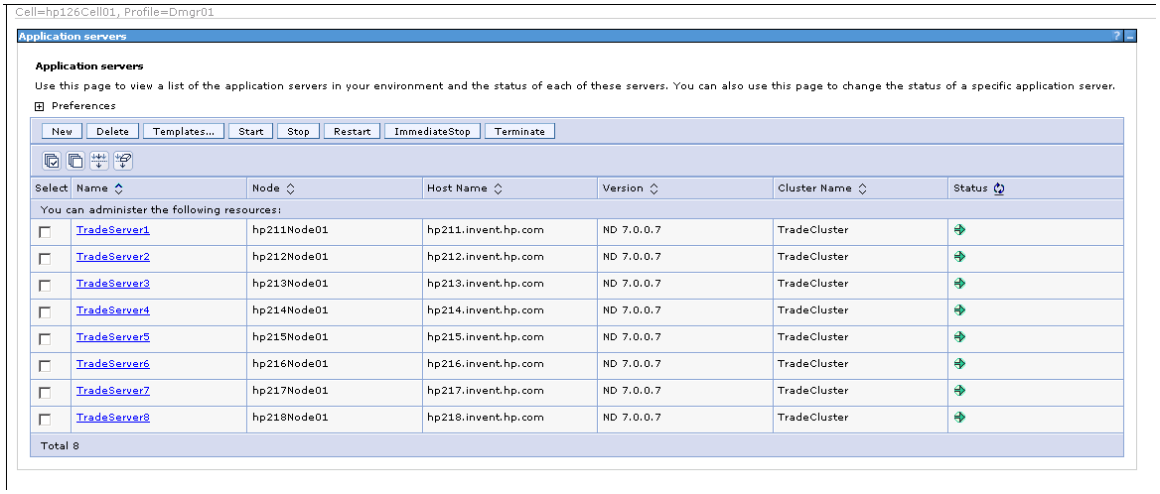
Table 1 shows the cluster configuration. IBM HTTP Server (IHS) was installed on the hp126 server to serve as a web server for the application servers. WebSphere deployment manager (dmgr) was configured on the hp126 server with all 8 virtual machine nodes as members of TradeCluster cluster. Four virtual machines are configured on each ESX server. These application servers are automatically started and federated into the cluster as part of the system startup script. Next section will provide instructions on how to startup the servers automatically.

Table 1. WebSphere cluster configuration

Cell name	Host name	Server name	ESX Server (VM name)	Cluster name
hp126Cell01 (Primary Cell)	• hp126 • hp126 • hp211 • hp212 • hp213 • hp214 • hp215 • hp216 • hp217 • hp218	• webserver (IHS server) • dmgr • TradeServer1 • TradeServer2 • TradeServer3 • TradeServer4 • TradeServer5 • TradeServer6 • TradeServer7 • TradeServer8	esx1 (rhel-vm1) esx1 (rhel-vm2) esx1 (rhel-vm3) esx1 (rhel-vm4) esx2 (rhel-vm5) esx2 (rhel-vm6) esx2 (rhel-vm7) esx2 (rhel-vm8)	TradeCluster

Figure 7 shows WebSphere Application Server cluster configuration on WebSphere Integrated Solutions Console with TradeCluster members with one application server on each virtual machine.

Figure 7. WebSphere cluster members



Automatically starting server processes

After you install the WebSphere Application Server product, set up a shell script to automatically monitor and restart any related server processes.

Locate the rc.was example shell script, which is in the *app_server_root*/bin directory. The script provides instruction in its header.

Execute the following command in profile bin directory

- startServer.sh TradeServer1 –script

The script will create start_TradeServer1.sh file and this file can be used to bring up application server on that machine.

Edit rc.was script

- launchScript=start_TradeServer1.sh

Edit the inittab file of the operating system, to add an entry for each shell script you have created.

```
wass:235:once:/opt/IBM/WebSphere/AppServer/bin/rc.was >/dev/console 2>&1
```

HTTP cluster

From WebSphere Integrated Solutions Console, plug-in file (plugin-cfg.xml) for IBM HTTP web server was created and propagated to the web server on hp126 server. When the plugin-cfg.xml is generated, all servers are initially listed under the PrimaryServers tag, which is an ordered list of servers to which the plug-in can send requests.

Within the Primary Servers, the plug-in will load balance across the defined servers using either a Round Robin or a Random algorithm. The default is Round Robin.

All application server details in the plugin-cfg.xml file are listed under the ServerCluster tag as illustrated in Example 1.

Example 1: primary servers

```
...
<ServerCluster>
...
    <PrimaryServers>
      <Server Name="hp211_server1"/>
      <Server Name="hp212_server1"/>
      <Server Name="hp213_server1"/>
      <Server Name="hp214_server1"/>
      <Server Name="hp215_server1"/>
      <Server Name="hp216_server1"/>
      <Server Name="hp217_server1"/>
      <Server Name="hp218_server1"/>
    </PrimaryServers>
  </ServerCluster>...
```

Oracle RAC configuration

The Oracle Grid computing architecture provides a highly available and scalable foundation for deploying any mission-critical applications.

Oracle Real Application Clusters (RAC)

RAC enables multiple cluster nodes, or servers, to act as a single processing engine wherein any node can respond to a database request. This design provides optimal availability since no failover is required in the event of a server outage; surviving cluster nodes continue to process transactions routinely. Additionally, various load balancing schemes can be configured within Oracle Grid Control to optimize performance across the cluster nodes and ensure transactions are processed on a priority basis.

RAC supports incremental system growth to better align IT investments with workload. As business demands on the database increase over time, processing capacity can be increased incrementally by adding servers to the database or application tier without interrupting system operations.

Oracle 11g R2 was installed on racnode1 and racnode2 with ASM (Automatic Storage Management) disks configured on EVA8400. The following public and private networks were configured on the system for Oracle RAC configuration.

Example 2: /etc/hosts

```
[oracle@racnode1 ora11g]$ cat /etc/hosts

# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1               localhost.localdomain localhost
::1                     localhost6.localdomain6 localhost6
# Sample Public IP address for RAC setup.
10.2.0.111                      racnode1.invent.hp.com  racnode1
```

```
10.2.0.115              racnode2.invent.hp.com  racnode2
# Sample Private IP address for RAC  and Middleware
10.1.0.111              racnode1-priv
10.1.0.115              racnode2-priv
# Sample Virtual IP address for RAC  and Middleware .
10.2.0.124              racnode1-vip
10.2.0.126              racnode2-vip
10.2.0.125              racnode-scan
```

After installing the Oracle Grid the cluster configuration is checked to see if all the resources of the cluster are configured properly. The following is the output from crsctl resources for the RAC configuration showing the services running on racnode1 and racnode2 servers.

Example 3: crsctl stat resource

```
[oracle@racnode1 ora11g]$ crsctl stat resource -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DATA.dg
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
ora.LISTENER.lsnr
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
ora.asm
               ONLINE  ONLINE       racnode1                 Started
               ONLINE  ONLINE       racnode2                 Started
ora.eons
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
ora.gsd
               OFFLINE OFFLINE      racnode1
               OFFLINE OFFLINE      racnode2
ora.net1.network
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
ora.ons
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
ora.registry.acfs
               ONLINE  ONLINE       racnode1
               ONLINE  ONLINE       racnode2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1        ONLINE  ONLINE       racnode1
ora.oc4j
      1        OFFLINE OFFLINE
ora.racnode1.vip
      1        ONLINE  ONLINE       racnode1
ora.racnode2.vip
      1        ONLINE  ONLINE       racnode2
```

```
ora.scan1.vip
      1        ONLINE  ONLINE       racnode1
ora.tradedb.db
      1        OFFLINE OFFLINE
      2        OFFLINE OFFLINE
```

The `OLSNODES` command provides the list of nodes and other information for all nodes participating in the cluster.

Example 4: olsnodes

```
[oracle@racnode1 ora11g]$ olsnodes -h
Usage: olsnodes [ [-n] [-i] [-s] [-t] [<node> | -l [-p]] | [-c] ] [-g] [-v]
        where
                -n print node number with the node name
                -i print virtual IP address with the node name
                -s print node status - active or inactive
                -c print clusterware name

[oracle@racnode1 ora11g]$ olsnodes -c
racnode-scan
[oracle@racnode1 ora11g]$ olsnodes -n -i -s
racnode1        1       racnode1-vip    Active
racnode2        2       racnode2-vip    Active
```

The Oracle Net listener (the listener) runs on your database host and handles incoming client requests. The following example shows `STATUS` output in the default display mode. The output contains: Listener configuration settings, Listening endpoints summary, Services summary, which is an abbreviated version of the SERVICES command output

The following is the output from Oracle lsnrctl on racnode1 showing the IP address and the port tradedb database is listening to and the services running on the server.

Example 5: lsnrctl status

```
[oracle@racnode1 ora11g]$ lsnrctl status

LSNRCTL for Linux: Version 11.2.0.1.0 - Production on 26-MAR-2010 12:21:11

Copyright (c) 1991, 2009, Oracle.  All rights reserved.

Connecting to (ADDRESS=(PROTOCOL=tcp)(HOST=)(PORT=1521))
STATUS of the LISTENER
------------------------
Alias                     LISTENER
Version                   TNSLSNR for Linux: Version 11.2.0.1.0 - Production
Start Date                07-MAR-2010 22:08:29
Uptime                    18 days 13 hr. 12 min. 42 sec
Trace Level               off
Security                  ON: Local OS Authentication
SNMP                      OFF
Listener Parameter File   /app/oracle/grid/network/admin/listener.ora
Listener Log File         /home/grid/app/grid/diag/tnslsnr/racnode1/listener/alert/log.xml
Listening Endpoints Summary...
```

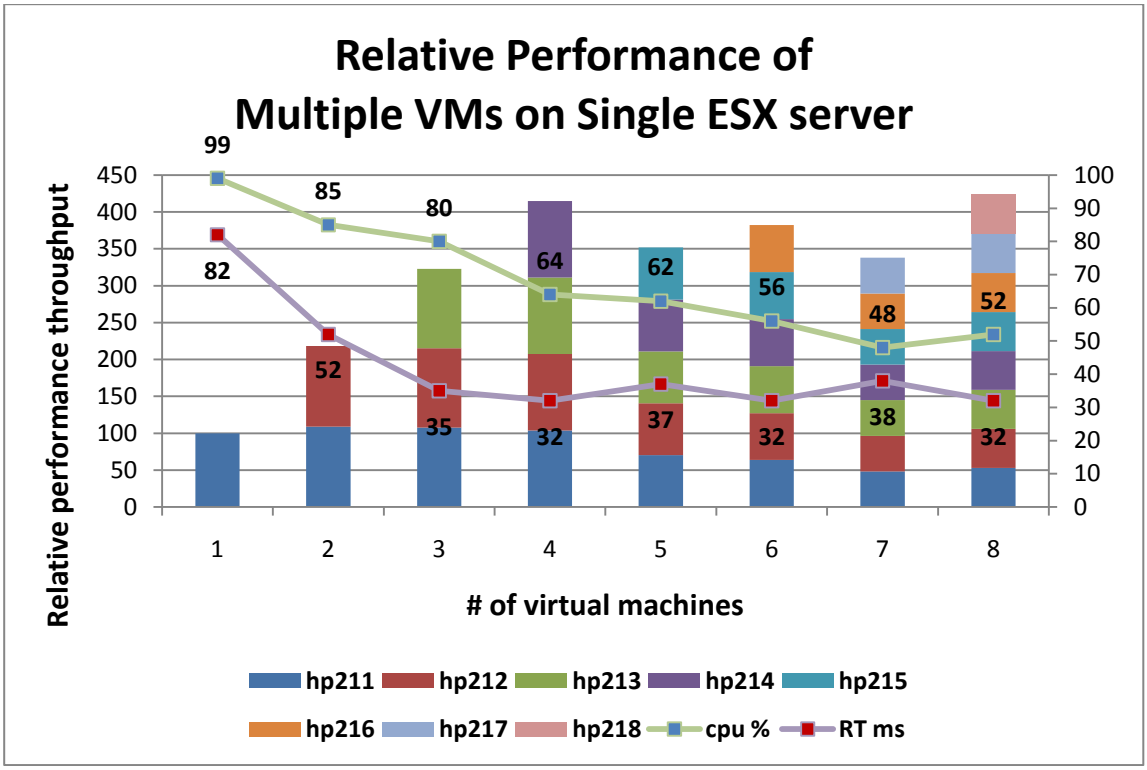
```
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=LISTENER)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=10.2.0.111)(PORT=1521)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=10.2.0.124)(PORT=1521)))
Services Summary...
Service "+ASM" has 1 instance(s).
  Instance "+ASM1", status READY, has 1 handler(s) for this service...
Service "tradedb" has 1 instance(s).
  Instance "tradedb1", status READY, has 1 handler(s) for this service...
Service "tradedbXDB" has 1 instance(s).
  Instance "tradedb1", status READY, has 1 handler(s) for this service...
The command completed successfully
```

WebSphere cluster test results

Apache DayTrader is an end-to-end benchmark and performance sample application built around an online stock trading system. The application allows users to login, view their portfolio, lookup stock quotes, and buy or sell stock shares. This benchmark implements J2EE 1.4 including the new Enterprise JavaBeans (EJB) 2.1 component architecture, Message Driven beans, transactions (1-phase, 2-phase commit) and Web Services (SOAP, WSDL). This DayTrader application represents 3-tier architecture involving the client, application server and backend database. Thus closely simulates real-world customer scenarios.

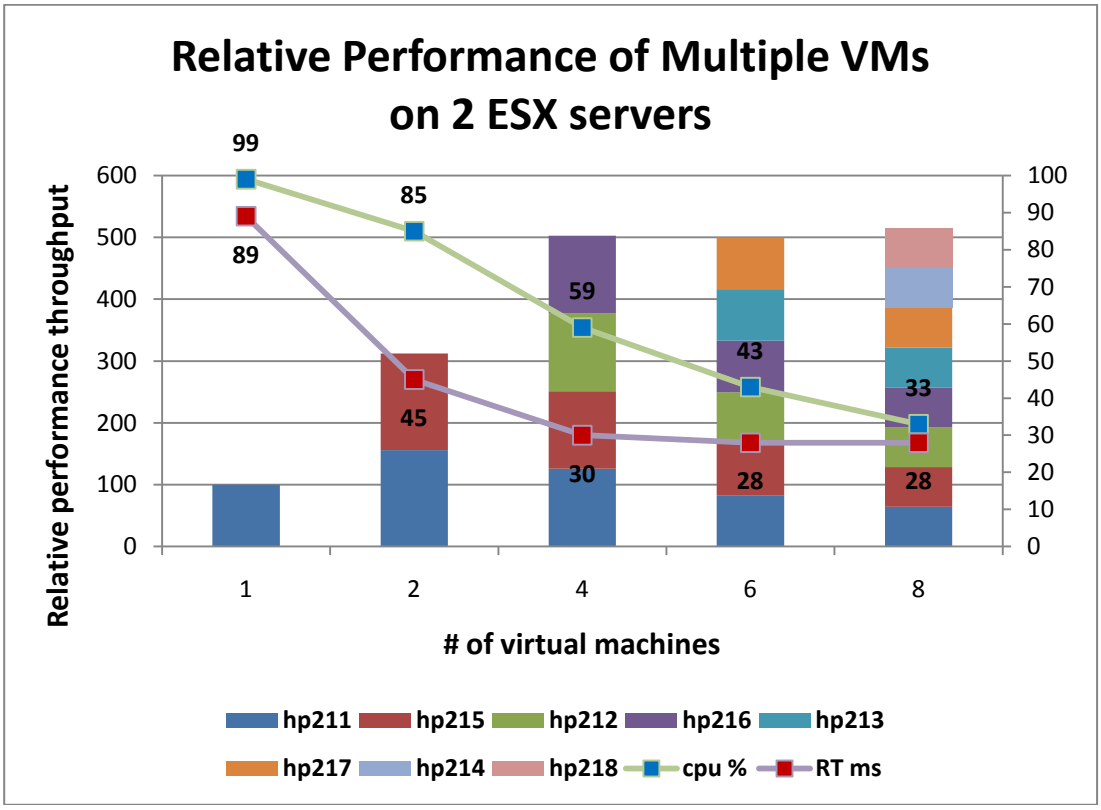
On the DayTrader application, a load of 100 virtual users (vusers) is generated using HP LoadRunner load generation tool to see the performance of the virtual machines. The following Figure 8 shows the relative performance results in comparison with one virtual machine with 2 vCPUs. The same load was applied by bringing up additional 8 virtual machines on the same ESX server (2 cores per VM, 16 cores total with hyper-threading enabled on the ESX server) and the performance throughput, CPU utilization and the response time for the transactions are calculated. As noted in the graph with additional virtual machines the CPU utilization on the virtual machines decreased and the response time improved, thus showing the performance improvement with additional virtual machines. We got the best results with 4 virtual machines (2 cores per VM, 8 cores on single CPU chip) as they were using one single physical CPU, thus reducing the overhead of scheduling across the 2 physical CPUs on the system.

Figure 8. Relative performance on Single ESX server



In the following Figure 9, we have used 4 virtual machines on one ESX server and another 4 virtual machines from another ESX server. The same 100 vuser load was applied and the performance throughput, CPU utilization and the response time for the transactions are calculated. The best results were seen with 4 virtual machines, 2 virtual machines on each ESX server. With additional virtual machines the CPU utilization on the virtual machines reduced and the response time also improved. Depending on the business needs and requirements appropriate number of virtual machine can be added to meet the requirements.

Figure 9. Relative performance on two ESX servers

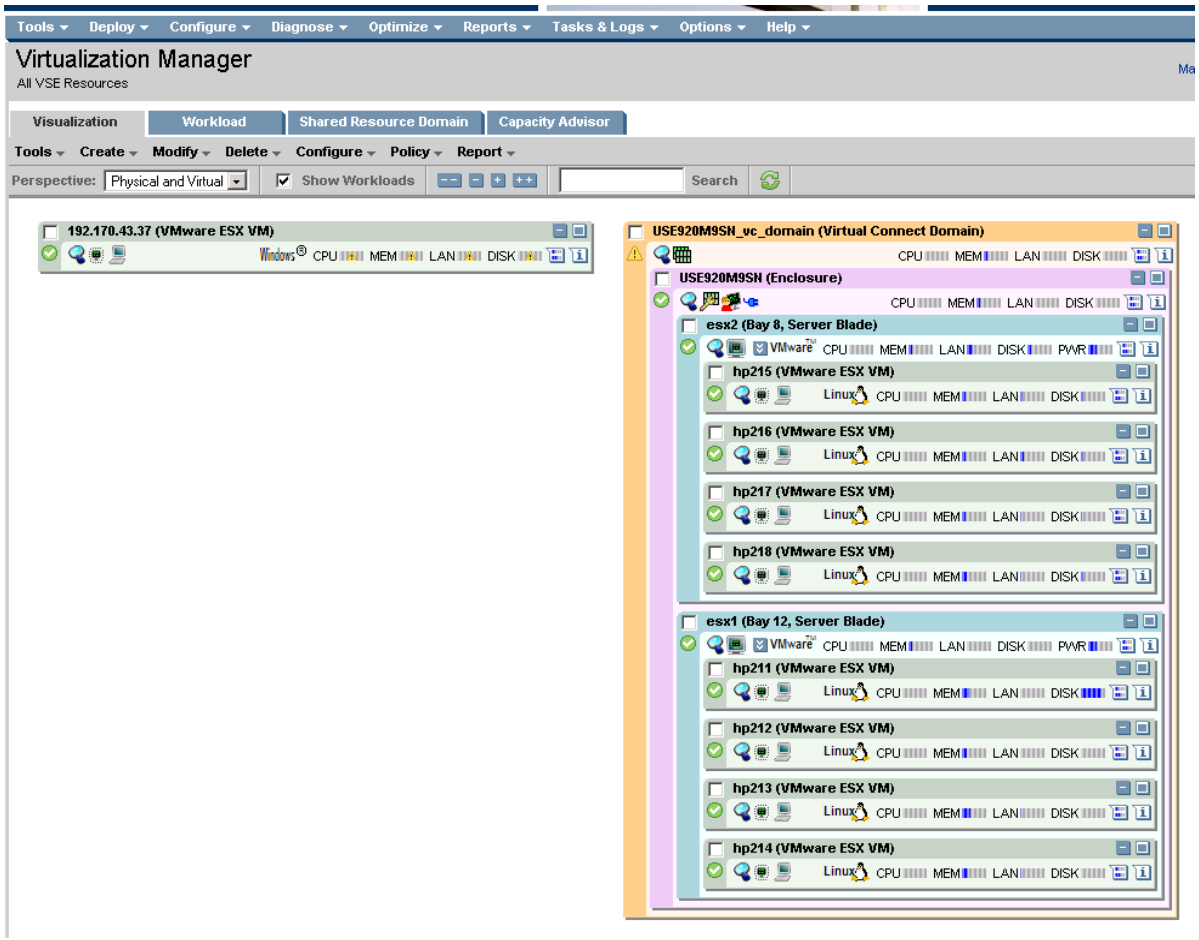


HP Insight Dynamics virtualization management

Figure 10 shows the output of the virtual resources available in the current configuration. The virtual machines hp211, hp212, hp213 and hp214 are on esx1 ESX server and hp215, hp216, hp217 and hp218 are on esx2 ESX server.

Logical server menu selection allows you to define a logical server, which includes the identity of the logical server, the amount of memory and number of CPU cores, and predefined network and storage configuration. All of the required information for the logical server must be defined before you can activate it, including at least one storage volume, one port and one network.

Figure 10. Virtualization Manager



Import logical server

Figure 11 shows how to import an existing virtual machine into a logical server. Import menu selection imports the definition for an existing physical server or virtual machine and creates an active logical server with that definition.

Figure 11. Import logical server

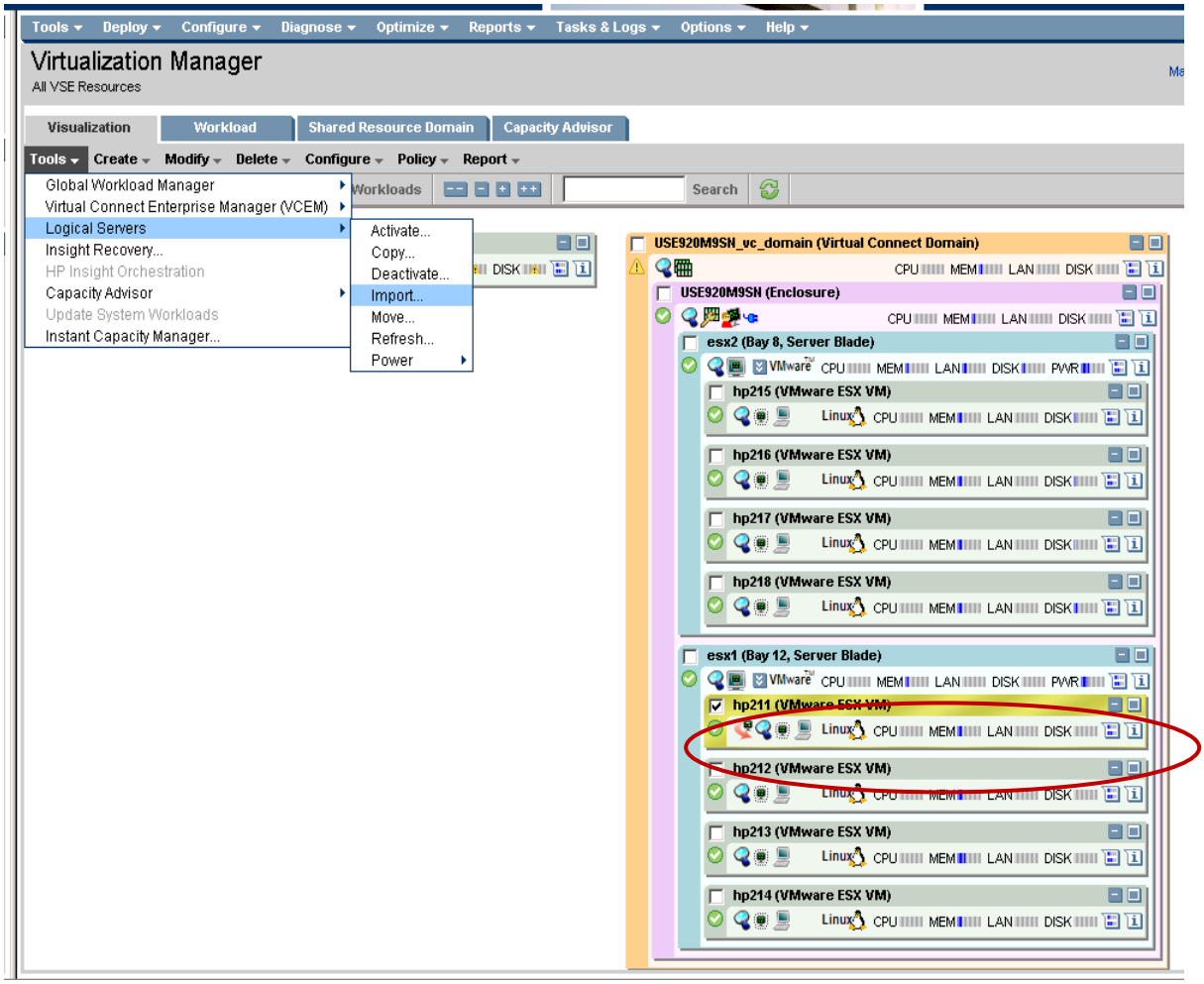
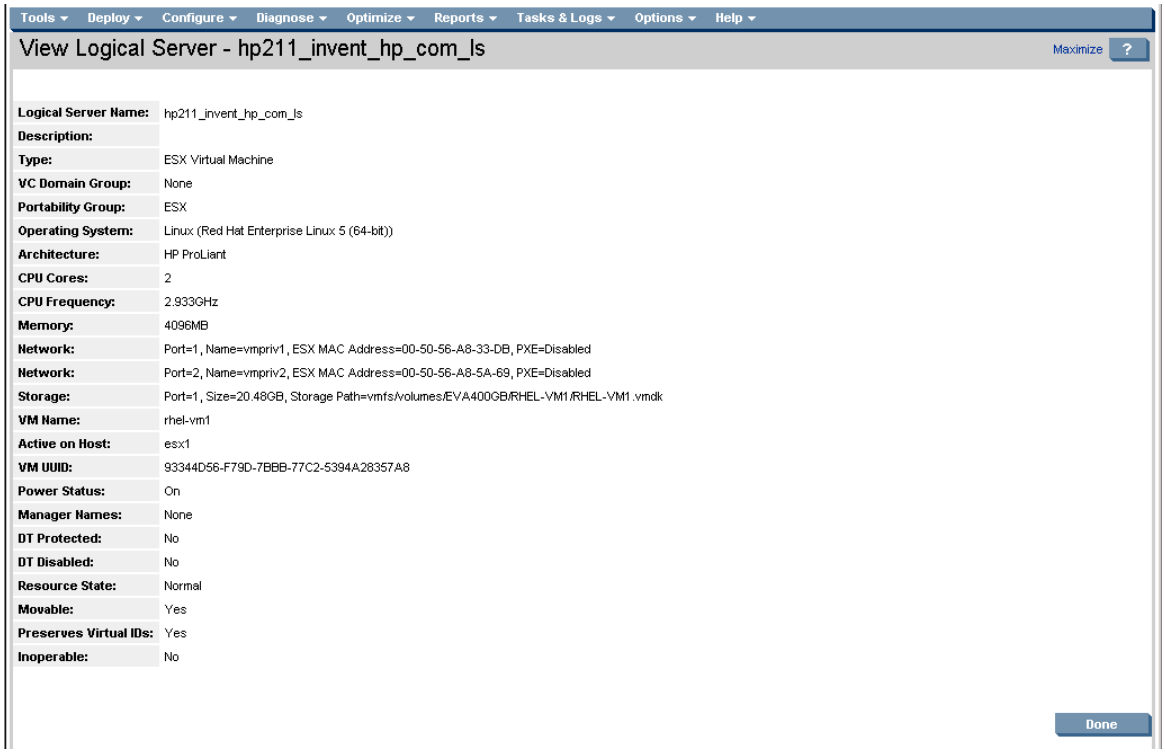


Figure 12 shows the information of the logical server created by importing an existing virtual machine. The figure shows the logical server configuration with 2 CPU cores, 4096 MB RAM, 2 network interfaces and 20 GB disk. Figure 11 shows only one virtual machine being imported (for demo purpose). All the virtual machines are imported and logical servers created in the reference configuration described in this paper.

Figure 12. View logical server



Use case 1: virtual machine activation and deactivation.

Using HP Systems Insight Manager Virtualization Manager, resources can be allocated and de-allocated as your business demands. With an adaptive WebSphere Application Server, you can size your data center for expected average usage instead of peak demands. You can pre-allocate logical servers for each cluster. When demand peaks for one server, a logical server is activated to handle the additional load. When the peak passes, the logical server is deactivated, returning the unused server to the spare pool. This can be done using activation and deactivation of logical servers described below.

Deactivate logical server

Deactivate menu selection removes the association between a logical server and a system. The storage configuration remains, maintaining the host name, IP address and user information on the operating system boot image. For virtual machines, the virtual machine is shut down and the virtual machine definition is unregistered. (If the logical server is reactivated, the virtual machine is reregistered.)

Figure 13 shows logical server (hp211) deactivation. This releases CPU and memory of the logical server resources from the ESX server. These resources can be allocated to another logical server depending on your business needs.

Figure 13. Deactivate logical server

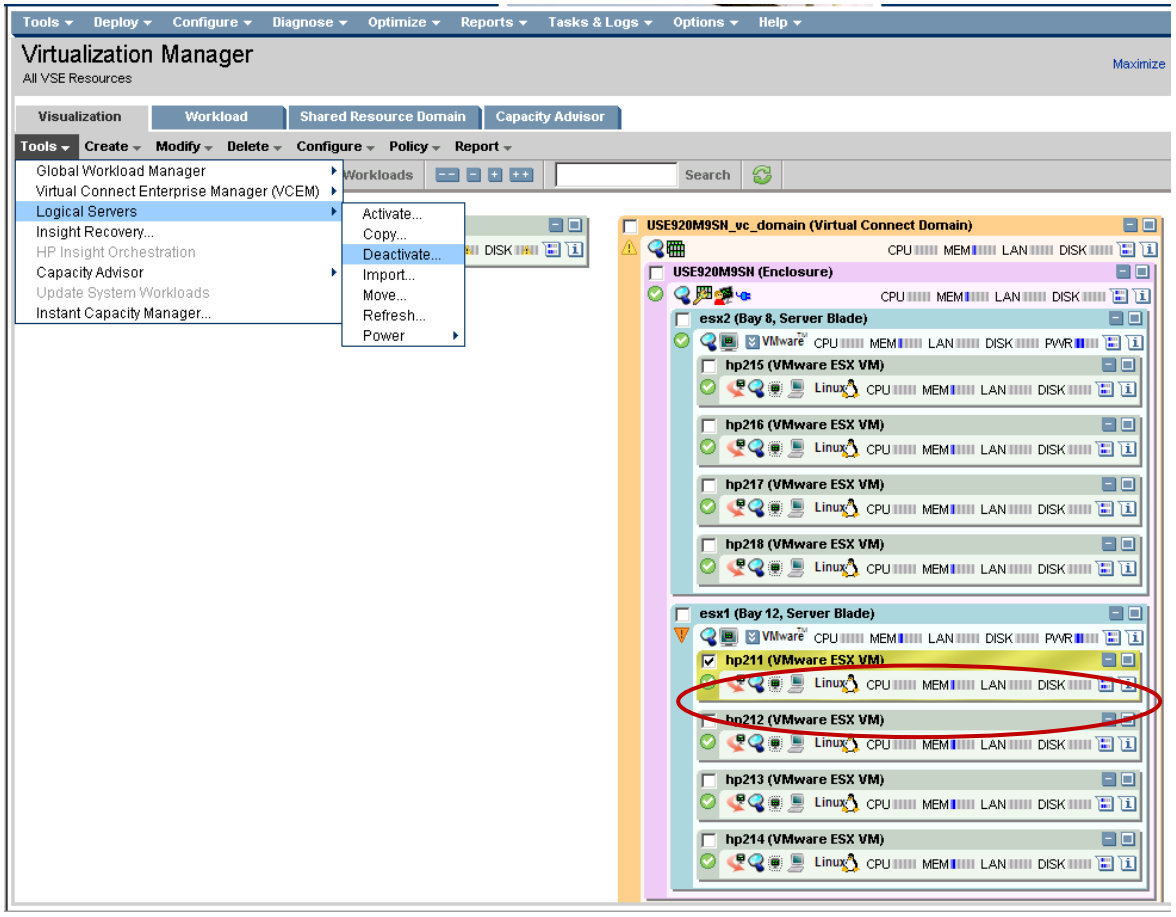


Figure 14 shows the steps taken during the deactivation process of a logical server. The virtual machine (hp211) is stopped and unregistered from the virtual machine host (esx1).

Figure 14. Deactivation status

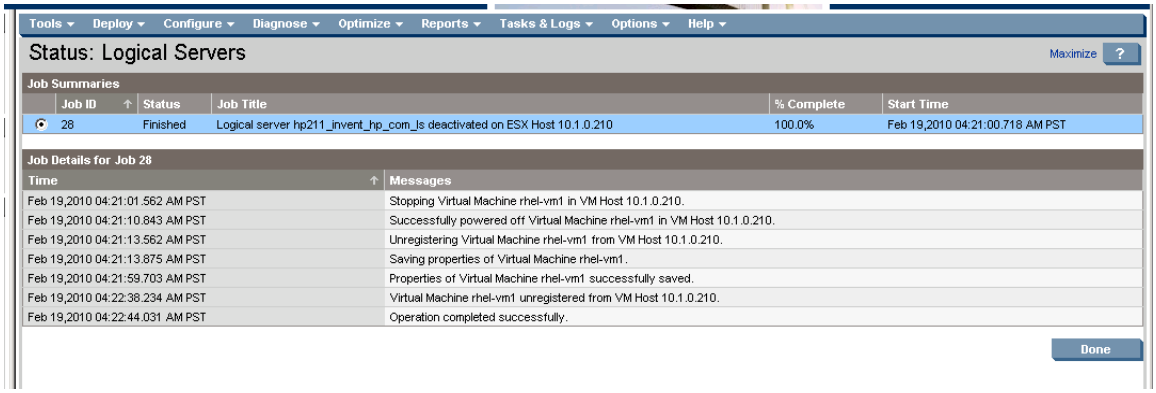
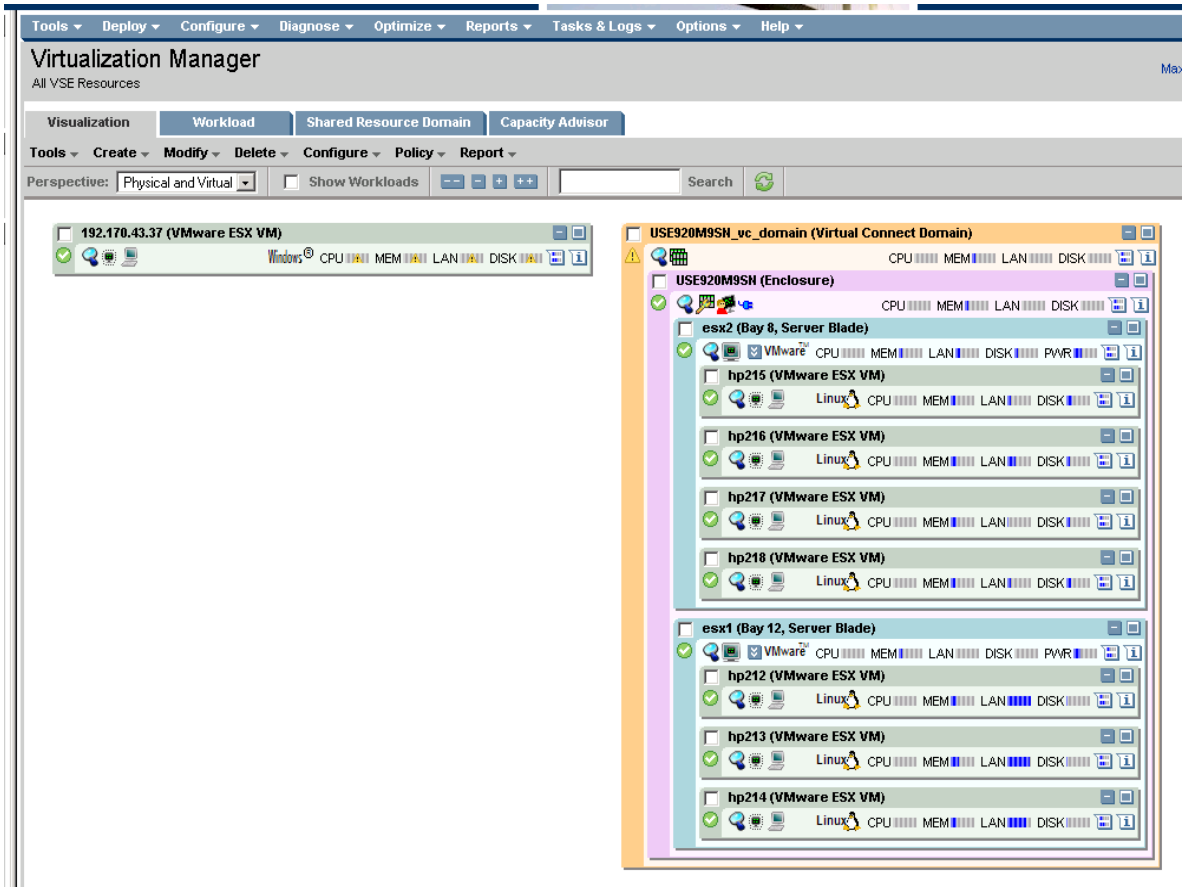


Figure 15 shows the Virtualization Manager after deactivation. Notice that the virtual machine (hp211) is not shows as it has been deactivated.

Figure 15. After deactivation

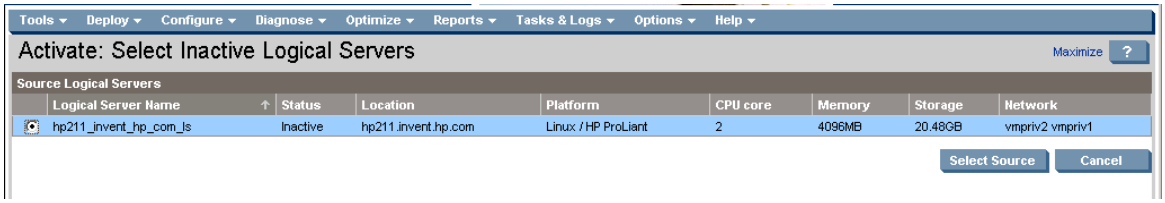


Activate logical server

Activate selection binds a logical server to a physical server or system. For ESX virtual machines, activating a logical server creates new virtual machines if one is not already created, registers it with the preexisting hypervisor and powers on the virtual machine.

Figure 16 shows inactive (deactivated) logical server that can be activated or assigned to a virtual machine host.

Figure 16. Activate logical server



When you select a target on which to activate the logical server, you are shows a Headroom rating that displays between one and five stars, with the higher number of starts denoting more excess resources are available on the target server. Figure 17 shows available servers that the logical server can be assigned to. ESX server esx1 virtual machine host is selected to activate the logical server. Once activated the Virtualization Manager will show hp211 virtual machine on esx1 server.

Figure 17. Activate logical server to target host

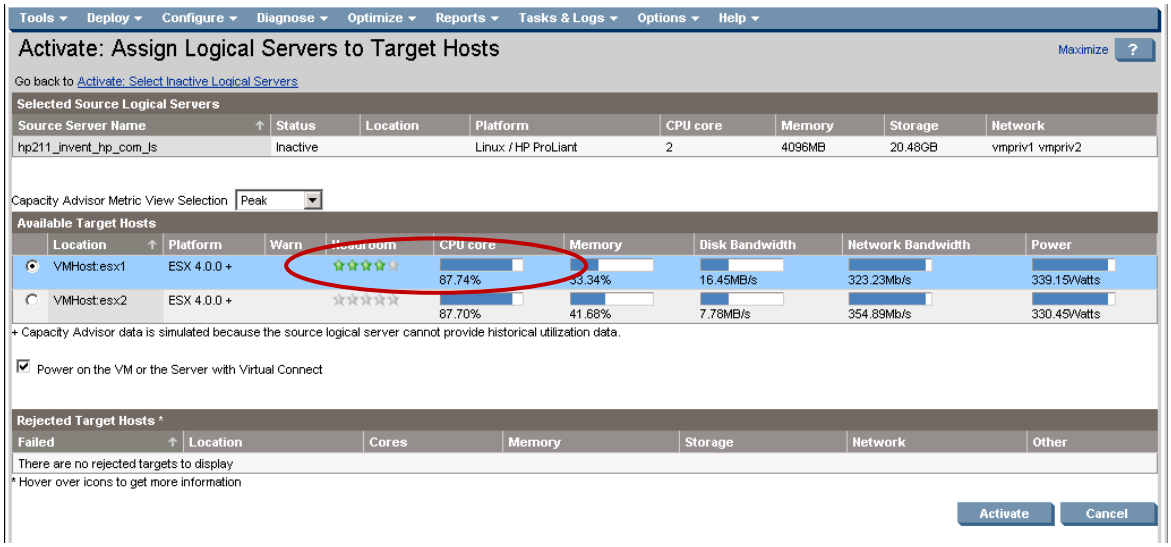
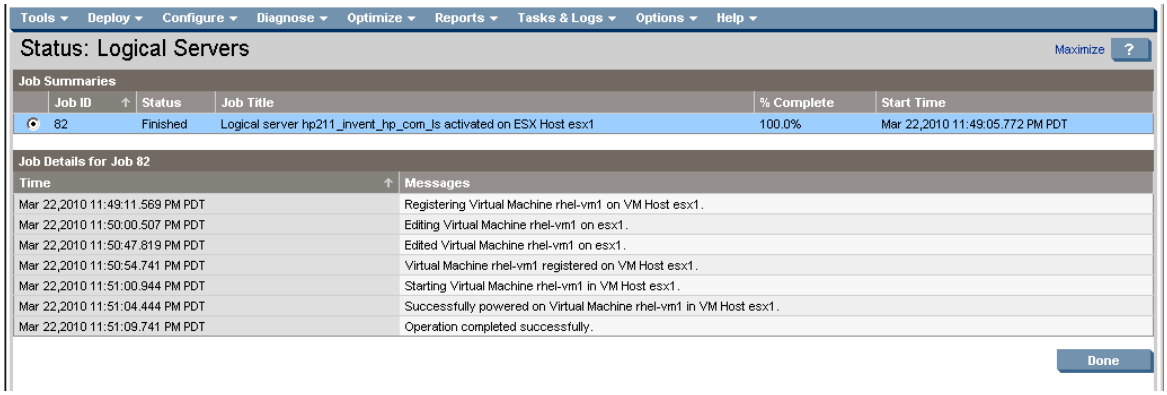


Figure 18 shows the status of the activation process. The virtual machine is registered and powered on esx1 virtual machine host.

Figure 18. Activate logical server status



After activation, WebSphere cluster status is checked to see if the server is active and is able to handle the requests from the web server. The test was successful and the logical server was able to process the requests from the http server.

Use case 2 – moving live logical servers

With Insight Dynamics, you can move a running logical server from one physical ESX server to another if there are free resources available on the other server so that the current resources on the existing server can be freed up for other workloads. This can be accomplished by "Live Move" described in next section. You cannot move virtual machine logical servers from one type of hypervisor to another type.

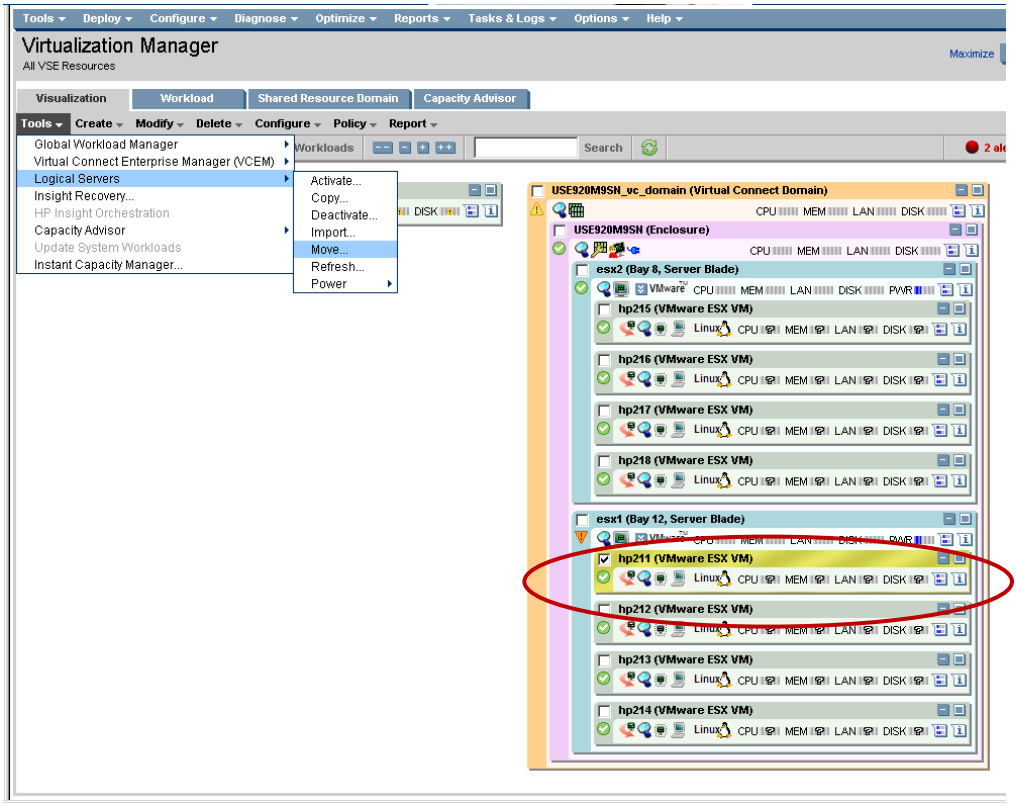
Logical server "Live Move"

Move menu selection moves an active logical server onto another host. The host can be a server (for Virtual Connect blade logical server) blade or a hypervisor (for an ESX virtual machine logical server).

"Live Move" initiates VMware VMotion technology from HP SIM and requires that vCenter is installed and running. This type of scenario is used in high availability configurations that minimize service interruptions. It moves a running virtual machine, its operating system, and its applications from one VM Host to another VM Host without an operating system reboot or application restart. All I/O connections to storage and networks remain active throughout the move

Figure 19 shows logical server (hp211) move from esx1 to esx2 virtual machine host.

Figure 19. Move logical server



When you select a target on which to activate the logical server, you are shown a Headroom rating that displays between one and five stars, with the higher number of starts denoting more excess resources are available on the target server.

Target hosts on which a logical server can be moved are shown in the Target Hosts table. Select one target blade in the Target Hosts table by clicking the radio button to the left of the target. Figure 20 shows the target host and headroom information to move the logical server. Select "Live Move" to move an online and running logical server from one virtual machine host to another. The web server did not report any errors regarding the application server. The requests from the web server were not lost as the move was taking place. Connection to the application server was also not lost. "Live Move" uses VMware VMotion technology for migrating the virtual machine from one ESX server to another.

Figure 20. Live move logical server to hosts

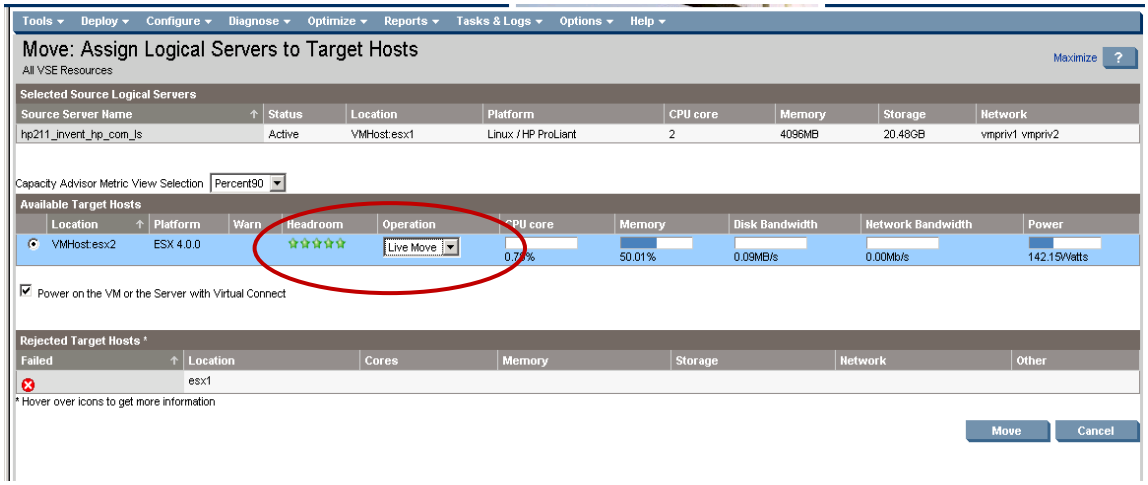


Figure 21 shows the status of the live move.

Figure 21. Logical server live move status

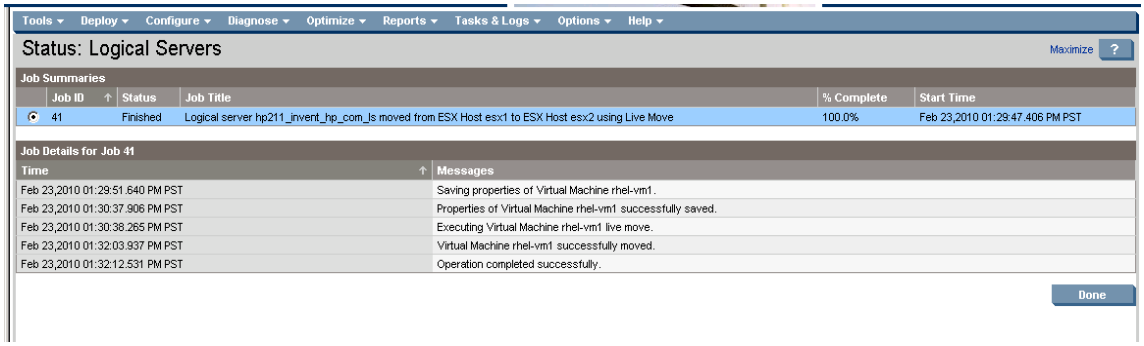
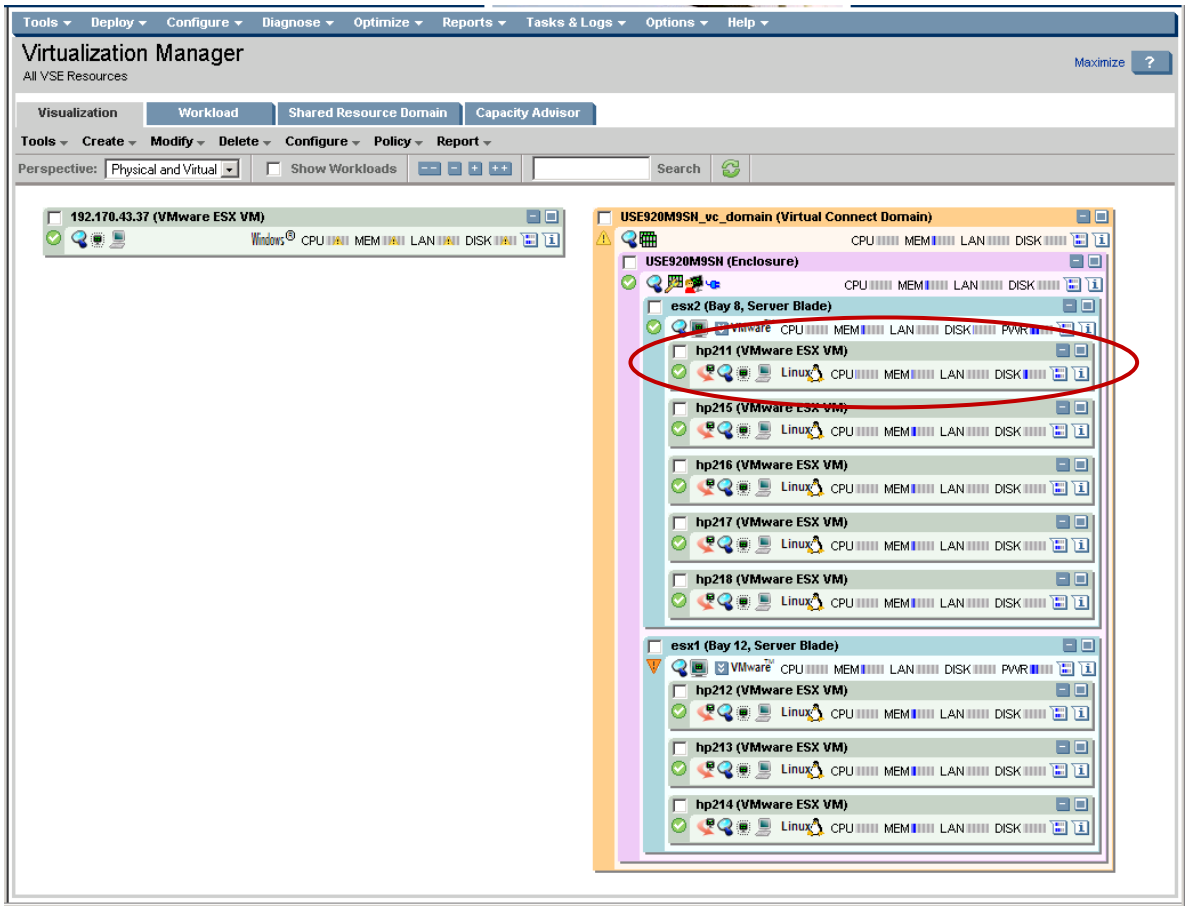


Figure 22 shows Virtualization Manager after live move. The virtual machine hp211 is now hosted by esx2 ESX server.

Figure 22. After logical server live move



To test this use case, a load of load of 100 vusers was generated by LoadRunner and "Live Move" was performed during the load. The http server did not report any errors during the live move and no errors were reported in http_plugin.log regarding connection problems even with load on the application server. The test was successful and the logical server was able to process the requests from the http server. We noticed a dip in the transaction throughput during "Live Move" (about 1 min) and then the transaction throughput rises to the same level as before the move.

Use case 3 – server recovery moving logical servers

With Insight Dynamics, reassigning a failed logical server is a two-step process that can be accomplished in a matter of minutes. The following steps are required:

1. Identify the failed logical server and select to move it.
2. Choose an available target server and confirm the move process. The logical server profile, including the network settings and storage mapping is moved to another ESX server.

You cannot move virtual machine logical servers from one type of hypervisor to another type. When the move completes, the logical server is powered up and assumes the identity of the failed logical server. The next section describes the steps.

For non-live moves, it's recommended that you shut down the virtual machine on which the logical server was activated before you move it. Otherwise, the virtual machine will be ungracefully shut down and powered off.

Logical server "SAN Move"

For non-live moves, moving a logical server shuts down the source virtual machine and removes the virtual machine definition. The target virtual machine is powered on, by default. The virtual disk is not copied to the target host. The target host accesses the virtual disks using storage area network (SAN) connectivity. You must stop the virtual machine for this move operation type. If the target host uses a SAN, a "SAN Move" can be performed. It moves the virtual machine from one ESX server to another. Figure 23 shows SAN Move of hp211 logical server from esx1 to esx2.

Figure 23. Logical server SAN Move

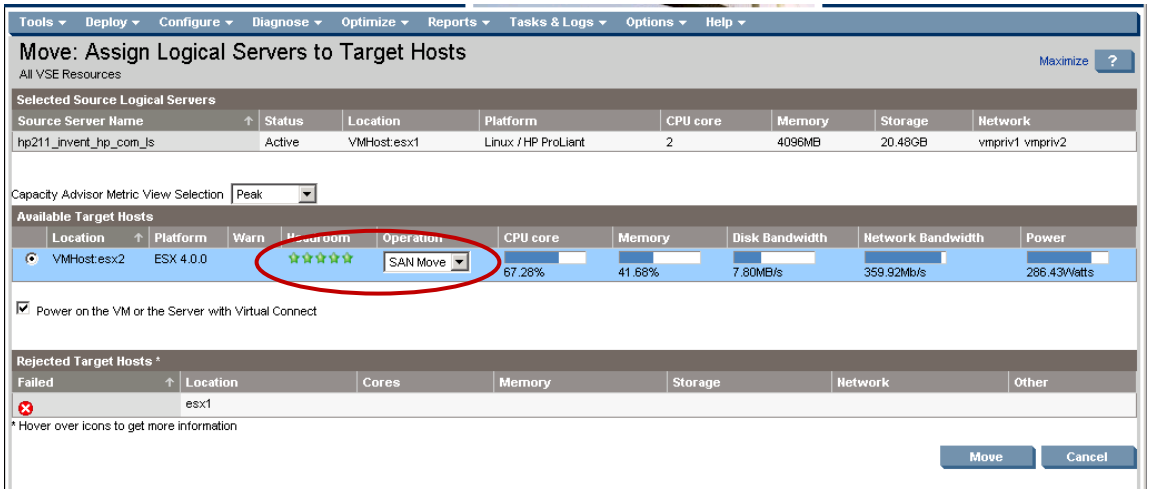


Figure 24 shows the status of SAN Move and the steps taken to move the logical server from one VM host to another. In this scenario, as the virtual machine is stopped, moved and started on the other node. The connectivity with the virtual machine is lost. The web server reports connection to the application server being lost till the virtual machine comes back up on the other virtual machine host.

Figure 24. Logical server SAN Move status

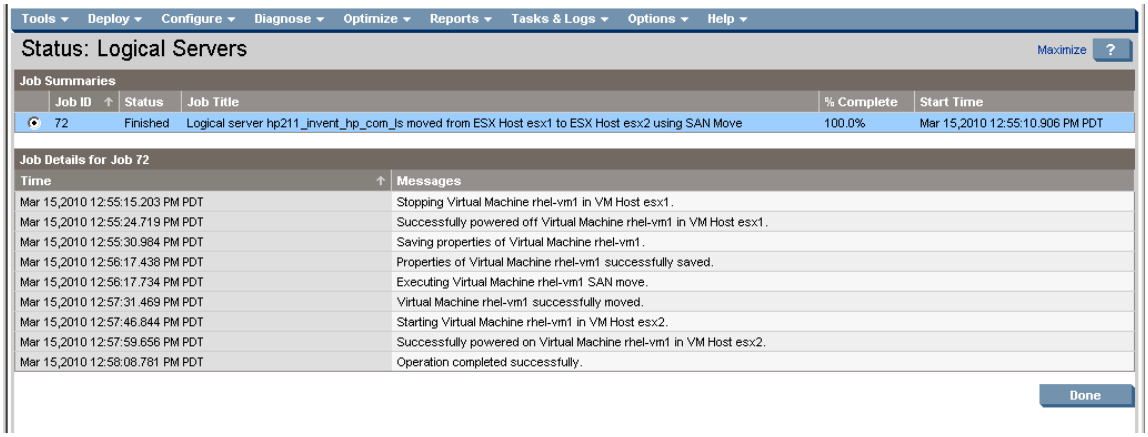
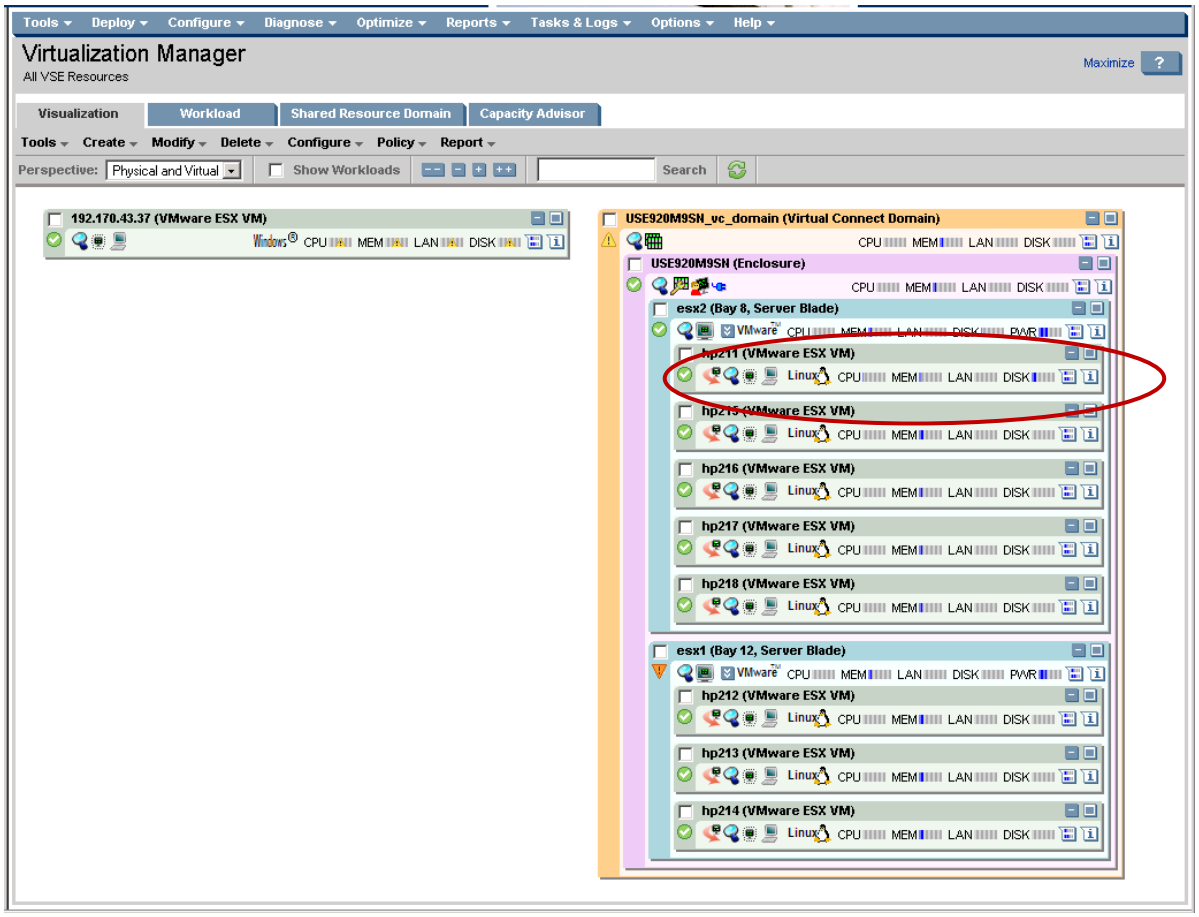


Figure 25 shows Virtualization Manager after SAN Move where hp211 virtual machine is hosted on esx2 server.

Figure 25. After logical server SAN Move



After "SAN Move", WebSphere cluster status is checked to see if the server is active and is able to handle the requests from the web server. The test was successful and the logical server was able to process the requests from the http server. The time to complete the move is about 3-5 minutes depending on the load on the ESX servers. While this does introduce downtime, the window is much smaller than the time required for performing a traditional server move operation.

Summary

The HP reference configuration for WebSphere Application Server with VMware ESX server combines the capabilities of all the components involved - WebSphere Application Server cluster for high availability, VMware ESX Server, vCenter and VMotion capabilities that provide the flexibility to move the logical servers, HP Insight Dynamics for easy manageability to optimize IT investment and improve overall service levels. The Virtualization Manager allows you to activate a logical server depending on the requirements of the business to meet the demand for additional resources. Using "Live Move", logical servers can be moved from one VM host to another seamlessly without disruption. You can use "SAN Move" for planned downtime or logical server's maintenance. These tools help accelerate application deployments in demanding IT environments.

Implementing a proof-of-concept

As a matter of best practice for all deployments, HP recommends implementing a proof-of-concept using a test environment that matches as closely as possible the planned production environment. In this way, appropriate performance and scalability characterizations can be obtained. For help with a proof-of-concept, contact an HP Services representative (http://www.hp.com/hps/contacts/index.html) or your HP partner.

Appendix A – Bill of materials

Table A. Bill of materials

Qty	Description
	Server Configuration
1	HP BLc3000 CTO 3 IN LCD ROHS Encl
4	HP BL460c G6 CTO Blade
4	HP X5570 BL460c G6 FIO Kit
4	HP X5570 BL460c G6 Kit
48	HP 4GB 2Rx4 PC3-10600R-9 Kit
8	HP 300GB 10K SAS 2.5 DP HDD
4	HP BLc QLogic QMH2462 FC HBA Opt Kit
2	HP BLc Virtual Connect 4Gb FC Opt Kit
2	HP BLc VC Flex-10 Enet Module Opt
	Storage Configuration
1	HP EVA8400 22GB Dual Controller Array
1	HP DL380 G5 Base Storage Server
112	HP EVA M6412A 146GB 15K FC Drive
10	HP M6412-A Fibre Channel Drive Enclosure
2	HP 8/24 Base 16-ports Enabled SAN Switch
1	HP Command View EVA8400 Unlimited LTU

For more information

HP Insight Dynamics for ProLiant, http://h18004.www1.hp.com/products/servers/management/vse/index.html

HP Virtual Connect Enterprise Manager, http://h18000.www1.hp.com/products/blades/components/ethernet/vcem/index.html

HP BladeSystem - Interconnects, http://h18004.www1.hp.com/products/blades/components/c-class-interconnects.html

HP ProLiant server, http://www.hp.com/go/proliant

VMware ESX server, http://www.vmware.com/products/esx/index.html

IBM WebSphere Application Server, http://www-01.ibm.com/software/webservers/appserv/was/

Intel® Xeon® processor, http://www.intel.com

Apache DayTrader 2.0 Benchmark Sample, http://cwiki.apache.org/GMOxDOC20/daytrader.html

Red Hat Enterprise Linux, http://www.redhat.com/rhel

To help us improve our documents, please provide feedback at http://h20219.www2.hp.com/ActiveAnswers/us/en/solutions/technical_tools_feedback.html.

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